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REPORT FOR CONSULTATION ON THE METROPOLITAN CHEYENNE INTRASTATE AIR QUALITY CONTROL REGION

National Air Pollution Control Administration
Washington, D. C.

August 1970

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U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
National Air Pollution Control Administration
August 1970

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PREFACE

The Clean Air Act, as amended, directs the Secretary of Health, Education, and Welfare to designate "air quality control regions" to provide a basis for the adoption of regional ambient air quality standards and the implementation of those standards. The Act stipulates that the designation of a region shall be preceded by consultation with appropriate State and local authorities. This report is intended to provide background information for a formal consultation. It proposes boundaries for the Metropolitan Cheyenne Intrastate Air Quality Control Region and discusses the factors which are the basis of the boundary proposal.

The Region* boundaries proposed in this report reflect consideration of available and pertinent information. However, the proposed boundaries remain subject to revisions suggested during the consultation with State and local authorities. Formal designation of the Region will be made only after a careful review of all opinions and suggestions submitted during the consultation process.

The National Air Pollution Control Administration appreciates assistance received from the several agencies of the State of Wyoming including the Division of Industrial Hygiene, Department of Public Health and the Wyoming Department of Economic Planning and Development.

* For the purposes of this report, the word "Region" when capitalized, will refer to the proposed Metropolitan Cheyenne Intrastate Air Quality Control Region.

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INTRODUCTION

THE REGIONAL APPROACH

Air pollution in the urban areas of the United States is a regional problem which frequently extends across State and local governmental boundaries. Since air pollution problems are rarely confined to any single municipality or county, successful control requires coordinated planning, standard setting, and enforcement by the several political jurisdictions which share a common problem. To date, State and local governments across the Nation have only begun to develop a regional approach to air pollution control.

The Clean Air Act, as amended, provides a regional approach which depends upon coordination and cooperation among all levels of government; municipal, county, State, and Federal. To set in motion the machinery for regional air pollution control, the Department of Health, Education, and Welfare designates air quality control regions, issues air quality criteria, and publishes reports on control techniques. The region designation identifies those State and local jurisdictions which will be involved in a regional air pollution control effort. The air quality criteria indicate the extent to which various concentrations of air pollutants are harmful to health and damaging to property. The reports on control techniques provide information on the costs and

effectiveness of various techniques for controlling air pollutant emissions.

After the Department of Health, Education, and Welfare completes these initial steps, State governments develop ambient air quality standards and plans for implementation of those standards for areas within air quality control regions. An air quality standard defines the desired limit on the concentration of a pollutant in the ambient air of the region. It represents the degree of air quality which the regional control program will attempt to achieve. An implementation plan is a blueprint of the steps which will be taken to insure achievement of the air quality standards within a reasonable time. The Governors have 90 days either from the time that they are furnished the criteria and control technology reports or from the time that a region is designated by the Department of Health, Education, and Welfare - whichever occurs last - to submit letters indicating their intent to set standards. They have an additional 180 days to set the standards, and another 180 days to develop plans for implementing those standards. The procedure for setting standards includes a public hearing which allows residents of a region to express their views concerning desired standards.

The Department of Health, Education, and Welfare reviews air quality standards and implementation plans in order to ascertain their consistency with the provisions of the Act.

When air quality standards and implementation plans are approved, States proceed to prevent and control air pollution in accordance with those standards and plans. This system for establishing a regional approach to air pollution control is outlined in Figure 1.

DESIGNATION OF AIR QUALITY CONTROL REGIONS

Designation of an air quality control region is one of the first steps in the regional approach to air pollution control. Section 107(a)(2) of the Clean Air Act, as amended, directs the Secretary, Department of Health, Education, and Welfare to make such designations. The portions of the section relevant to this discussion state:

> "...The Secretary, after consultation with appropriate State and local authorities shall...designate air quality control regions based on jurisdictional boundaries, urban-industrial concentrations, and other factors including atmospheric areas necessary to provide adequate implementation of air quality standards. The Secretary may... revise the designation of such regions...The Secretary shall immediately notify the Governor or Governors of the affected State or States of such designation."

Procedure for Designation of Regions

Figure 2 illustrates the procedures used by the National Air Pollution Control Administration (NAPCA) to designate air quality control regions.

After evaluating relevant technical and urban factors, the National Air Pollution Control Administration publishes a proposed delineation of the region boundaries. At the same time NAPCA sets a time and place for a consultation meeting and distributes to

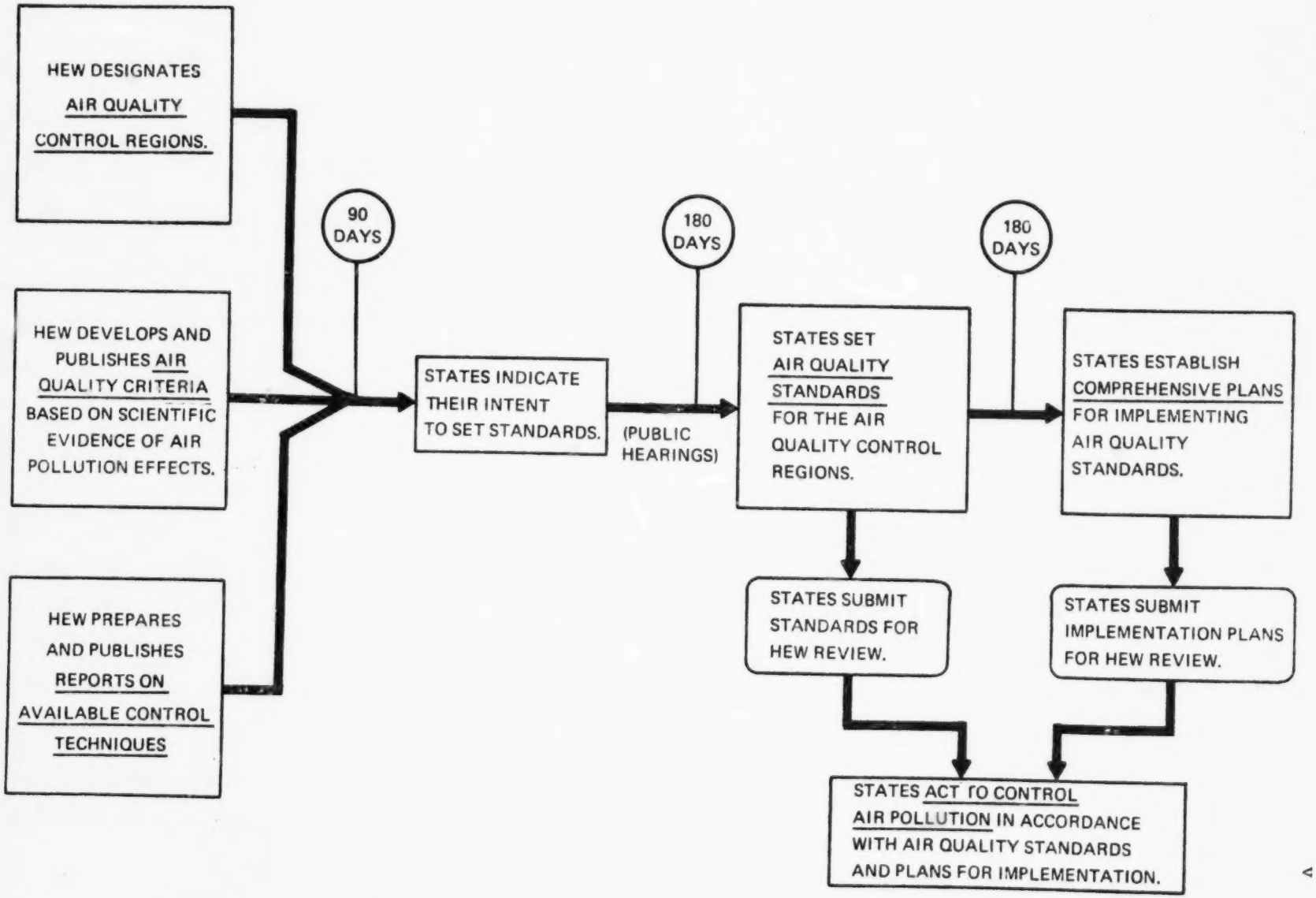

HEW DESIGNATES AIR QUALITY CONTROL REGIONS.
HEW DEVELOPS AND PUBLISHES AIR QUALITY CRITERIA BASED ON SCIENTIFIC EVIDENCE OF AIR POLLUTION EFFECTS.
HEW PREPARES AND PUBLISHES REPORTS ON AVAILABLE CONTROL TECHNIQUES
90 DAYS
STATES INDICATE THEIR INTENT TO SET STANDARDS.
180 DAYS
(PUBLIC HEARINGS)
STATES SET AIR QUALITY STANDARDS FOR THE AIR QUALITY CONTROL REGIONS.
180 DAYS
STATES ESTABLISH COMPREHENSIVE PLANS FOR IMPLEMENTING AIR QUALITY STANDARDS.
STATES SUBMIT STANDARDS FOR HEW REVIEW.
STATES SUBMIT IMPLEMENTATION PLANS FOR HEW REVIEW.
STATES ACT TO CONTROL AIR POLLUTION IN ACCORDANCE WITH AIR QUALITY STANDARDS AND PLANS FOR IMPLEMENTATION.

Figure 1 FLOW DIAGRAM FOR ACTION TO CONTROL AIR POLLUTION ON A REGIONAL BASIS, UNDER THE CLEAN AIR ACT, AS AMENDED

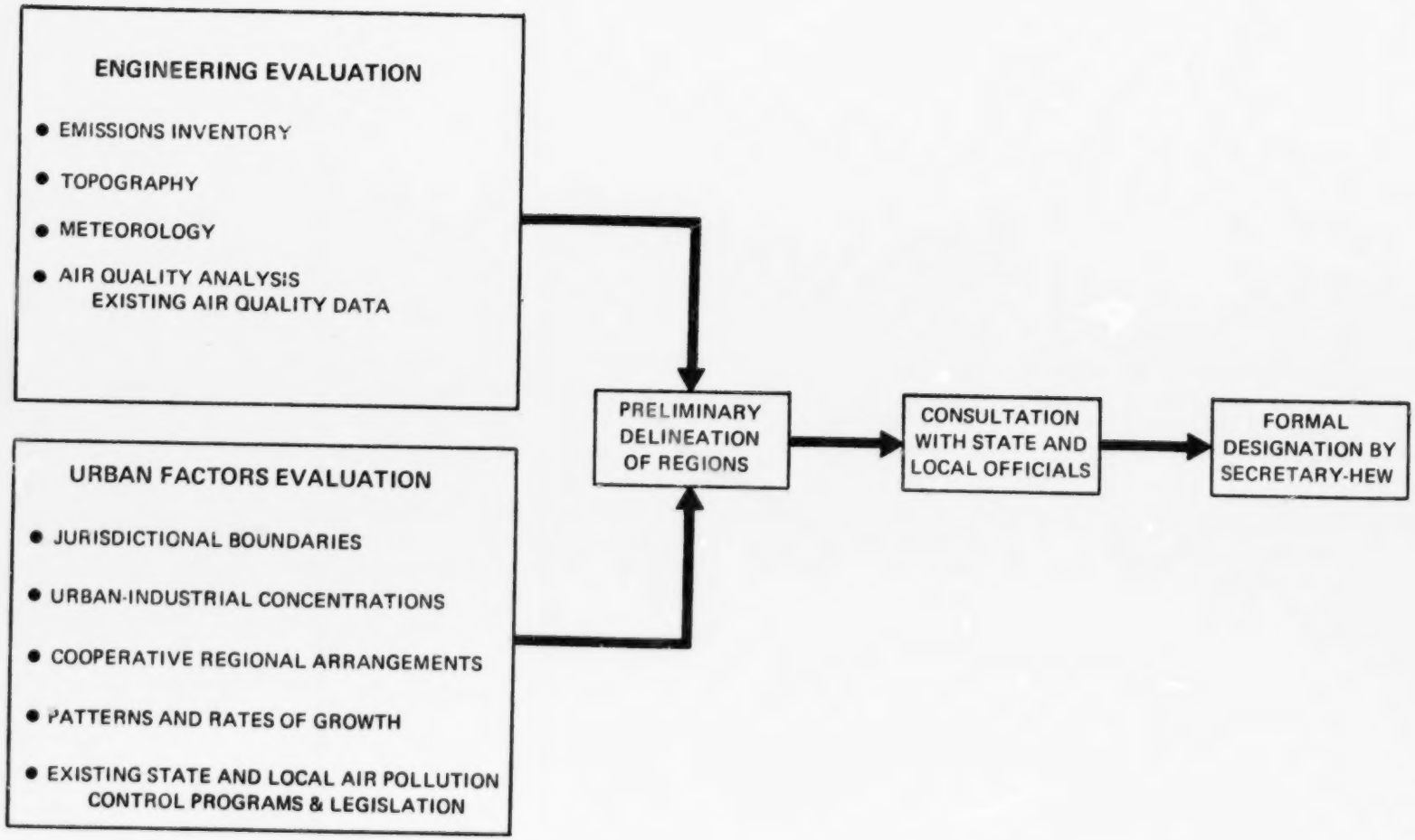

ENGINEERING EVALUATION
• EMISSIONS INVENTORY
• TOPOGRAPHY
• METEOROLOGY
• AIR QUALITY ANALYSIS
EXISTING AIR QUALITY DATA
URBAN FACTORS EVALUATION
• JURISDICTIONAL BOUNDARIES
• URBAN-INDUSTRIAL CONCENTRATIONS
• COOPERATIVE REGIONAL ARRANGEMENTS
• PATTERNS AND RATES OF GROWTH
• EXISTING STATE AND LOCAL AIR POLLUTION CONTROL PROGRAMS & LEGISLATION
PRELIMINARY DELINEATION OF REGIONS
CONSULTATION WITH STATE AND LOCAL OFFICIALS
FORMAL DESIGNATION BY SECRETARY-HEW

Figure 2. FLOW DIAGRAM FOR THE DESIGNATION OF AIR QUALITY CONTROL REGIONS.

State and local authorities a report of the evaluation study (such as this "Report for Consultation") which includes the boundary proposal. At the consultation meeting State and local authorities are encouraged to present fully their views and suggestions concerning the proposed boundaries of the region. Interested parties who do not have official status may submit comments in written form for the record. After careful review of all suggestions and opinions submitted for the record by interested parties, the Secretary of Health, Education, and Welfare makes a formal designation of the region boundaries and notifies the Governor(s) of the State(s) affected by the designation.

The Size of a Region

As stipulated in Section 107(a)(2), the designation of air quality control regions should be based on "jurisdictional boundaries, urban-industrial concentrations, and other factors including atmospheric areas necessary to provide adequate implementation of air quality standards." This language suggests a number of objectives which are important in determining how large an air quality control region should be. Basically, these objectives can be divided into three separate categories.

First, a region should be self-contained with respect to air pollution sources and receptors. In other words, a region should include most of the important sources in the area as well as most of the people and property affected by those sources. In this way, all the major elements of the regional problem will lie within

one unified administrative jurisdiction. Unfortunately, since air pollutants can travel long distances, it is impractical if not impossible to delineate regions which are completely self-contained. The air over a region will usually have at least trace amounts of pollutants from external sources. During episodic conditions, such contributions from external sources may even reach significant levels. Conversely, air pollution generated within a region and transported out of it can affect external receptors to some degree. It would be impractical and inefficient to make all air quality control regions large enough to encompass these low-level trace effects. The geographic extent of trace effects overestimates the true problem area which should be the focus of air pollution control efforts. Thus, the first objective, that a region be self-contained, becomes a question of relative magnitude and frequency. The dividing line between "important influence" and "trace effect" will a matter of judgment. The judgment should be based on estimates of the impact a source has upon a region, and the level of pollution to which receptors are subjected. In this respect, annual and seasonal data on pollutant emissions and ambient air concentrations. are a better measure of relative influence than short term data on episodic conditions.

The second general objective requires that region boundaries be designed to meet not only present conditions but also future

conditions. In other words, the region should include areas where industrial and residential expansion are likely to create air pollution problems in the foreseeable future. This objective requires careful consideration of existing metropolitan development plans, expected population growth, and projected industrial expansion. Such considerations should result in the designation of regions which will contain the sources and receptors of regional air pollution for a number of years to come. Of course, region boundaries need not be permanently fixed, once designated. Boundaries should be reviewed periodically and altered when changing conditions warrant readjustment.

The third objective is that region boundaries should be compatible with and even foster unified and cooperative governmental administration of the air resource throughout the region. Air pollution is a regional problem which often extends across several municipal, county, and even State boundaries. Clearly, the collaboration of several governmental jurisdictions is prerequisite to the solution of the problem. Therefore, the region should be delineated in a way which encourages regional cooperation among the various governmental bodies involved in air pollution control. In this regard, the existing pattern of governmental cooperation on the whole range of urban problems may become an important consideration. Certainly the pattern of cooperation among existing air pollution control programs is a relevant factor.

In general, administrative considerations dictate that governmental jurisdictions should not be divided. Although it would be impractical to preserve State jurisdictions undivided, usually it is possible to preserve the unity of county governments by including or excluding them in their entirety. Occasionally, even this would be impractical due to a county's large size, wide variation in level of development, or striking topographical features.

To the extent that any two of the above three objectives lead to imcompatible conclusions concerning region boundaries, the region must represent a reasonable compromise. A region should represent the best way of satisfying the three objectives simultaneously.

As noted above, the evaluation of relevant technical factors and urban factors forms the basis of the boundary proposals published by NAPCA. The evaluation of technical factors is designed to indicate, where possible, the location of pollution sources and the geographic extent of serious pollutant concentrations in the ambient air. The quantity, locations, and nature of air pollutant emissions are determined by conducting an inventory of the various pollutant generators in an area. The transport and distribution of pollutants in the ambient air are analyzed on the basis of measured air quality data, the location of emissions, meteorological data, and topographic information. A mathematical diffusion model, which predicts ambient pollution concentrations from information on emissions and meteorology, can be used in areas where irregular

topographical features would not invalidate the theoretical model. As a whole, the technical study indicates how large the air quality control region must be in order to encompass most pollution sources and most people and property affected by those sources.

The study of urban factors encompasses a different set of considerations. It reviews existing governmental jurisdictions, the location of urban and industrial concentrations expected patterns of urban growth, cooperative regional arrangements, existing State and local air pollution control programs, and other associated factors. As a whole, the study of urban factors is designed to indicate how large a region must be in order to encompass expected regional growth and to encourage cooperation among political units in controlling air pollution.

The body of this report contains a proposal for the boundaries of the Metropolitan Cheyenne Intrastate Air Quality Control Region and outlines the evaluation of technical and urban factors which was the basis of the proposal. The report is intended to serve as the background document for the formal Consultation with appropriate State and local authorities.

EVALUATION OF URBAN FACTORS

INTRODUCTION

The Clean Air Act calls for the designation of air quality control regions based on "jurisdictional boundaries, urban-industrial concentrations, and other factors" to provide an intergovernmental system for the prevention and control of air pollution. The designation of air quality control regions must also be based on a consideration of existing cooperative regional arrangements, population concentrations, location of industry, and patterns and rates of urban growth. The following discussion of urban factors will present these considerations as they apply to the metropolitan Cheyenne area.

POPULATION DISTRIBUTION

Human activity in its many different forms is the basic cause of air pollution. Thus, existing and potential air pollution problems may be related to geographic areas by study present and projected population statistics for those areas.

On the whole, southeastern Wyoming is sparsely settled. There are only three cities with populations exceeding 20,000 in the study area - Casper, Cheyenne and Laramie. These three cities have a combined population of 100,000 - more than 50% of the total for the entire eight-county study area. As indicated on the map of the study area in Figure 3, these cities are essentially isolated from

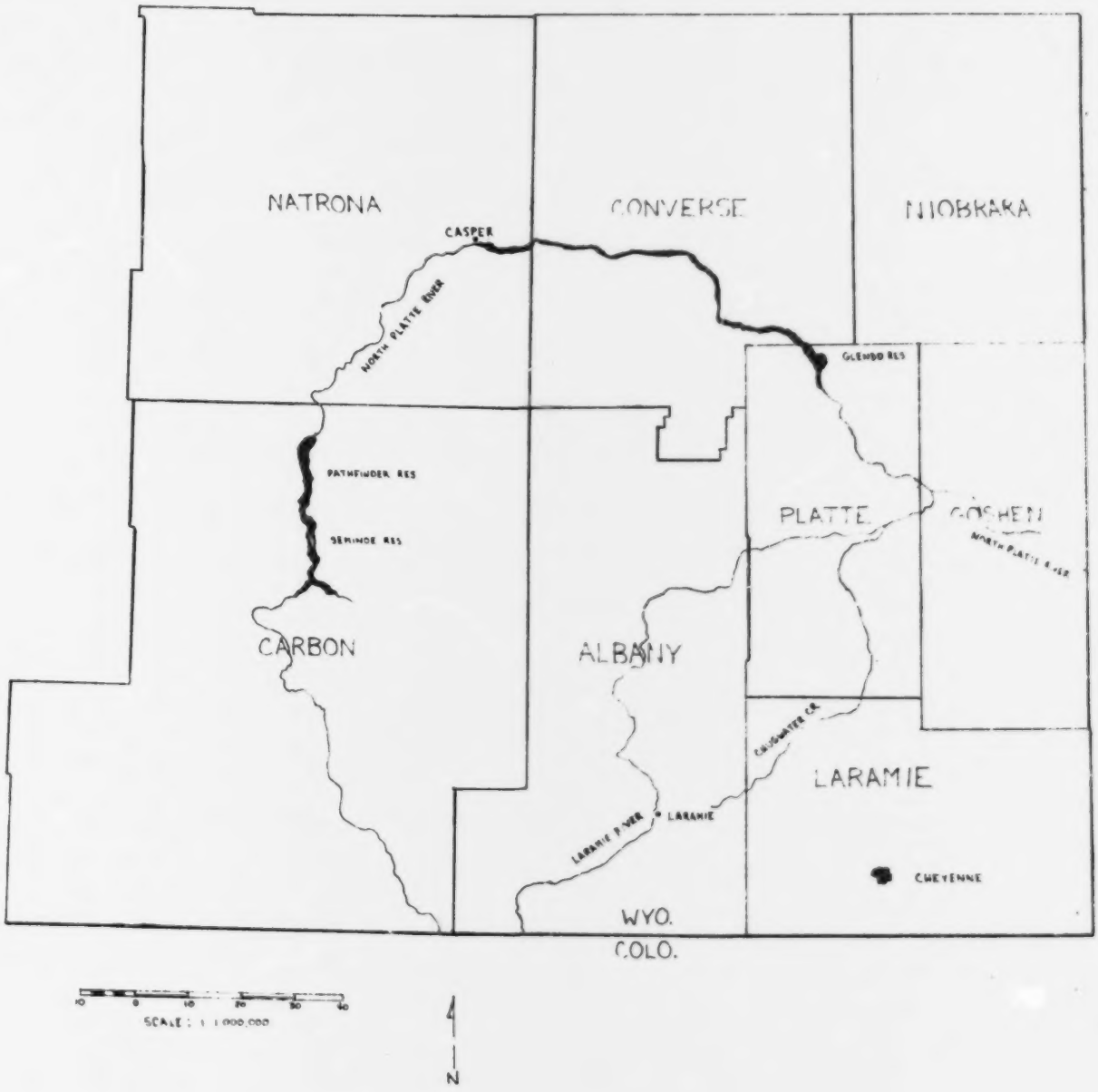


FIGURE 3. COUNTIES IN STUDY AREA FOR PROPOSED METROPOLITAN CHEYENNE INTRASTATE AIR QUALITY CONTROL REGION

one another both by distance and the rugged terrain.

The rest of the population is distributed among the rural areas. Table I presents existing and projected populations for each of the counties in southeastern Wyoming. The data indicates that Laramie, with a 1970 projected population of 59,500 is by far the largest county in the study area. Following Laramie in population are Natrona and Albany Counties, with 1970 population estimates of 46,000 and 24,5000, respectively, the major portion of which reside in Casper (Natrona) and Laramie (Albany). As Figure 4 indicates, the county population densities are extremely low, ranging from 1.3 persons/sq. mile in Carbon and Niobrara Counties to 22.0 persons/sq. mile in Laramie County. For the entire study area, the 1970 population density is an estimated 5.3 persons/sq. mile - very low when compared to the nationwide figure of 57.3 persons/sq. mile.

Projected levels of population presented in Table I indicate that Albany, Carbon, Laramie and Natrona Counties will all experience large population increases by 1980. Laramie and Natrona Counties will add the most people in the next decade, 14,300 and 16,200, respectively for percentage increases of 24.0% and 35.2%. However, projections show that Converse, Goshen, Niobrara, and Platte Counties will lose population by 1980. The most substantial decreases - 2,100 and 1,100 will occur in Platte and Niobrara Counties,

TABLE I

PRESENT AND PROJECTED POPULATION DATA BY JURISDICTION [1/]

County	Land Area (Mi)	Estimated Population 1970	Population Density 1970 (persons/mi)	Projected Population 1980	Population Density 1980 (Persons/mi)	Percent Change (1970-80)
Albany	4,248	24,500	5.8	31,400	7.4	+28.2
Carbon	7,905	10,100	1.3	13,300	1.7	+31.7
Converse	4,282	5,800	1.4	4,850	1.1	-16.4
Goshen	2,228	10,900	4.9	10,000	4.5	-8.3
Laramie	2,703	59,500	22.0	73,800	27.3	+24.0
Natrona	5,342	46,000	8.6	62,200	11.7	+35.2
Niobrara	2,614	3,300	1.3	2,200	0.8	-33.3
Platte	2,086	6,400	3.1	4,300	2.1	-32.8
TOTALS	31,408	166,500	5.3	202,050	6.4	+2.1

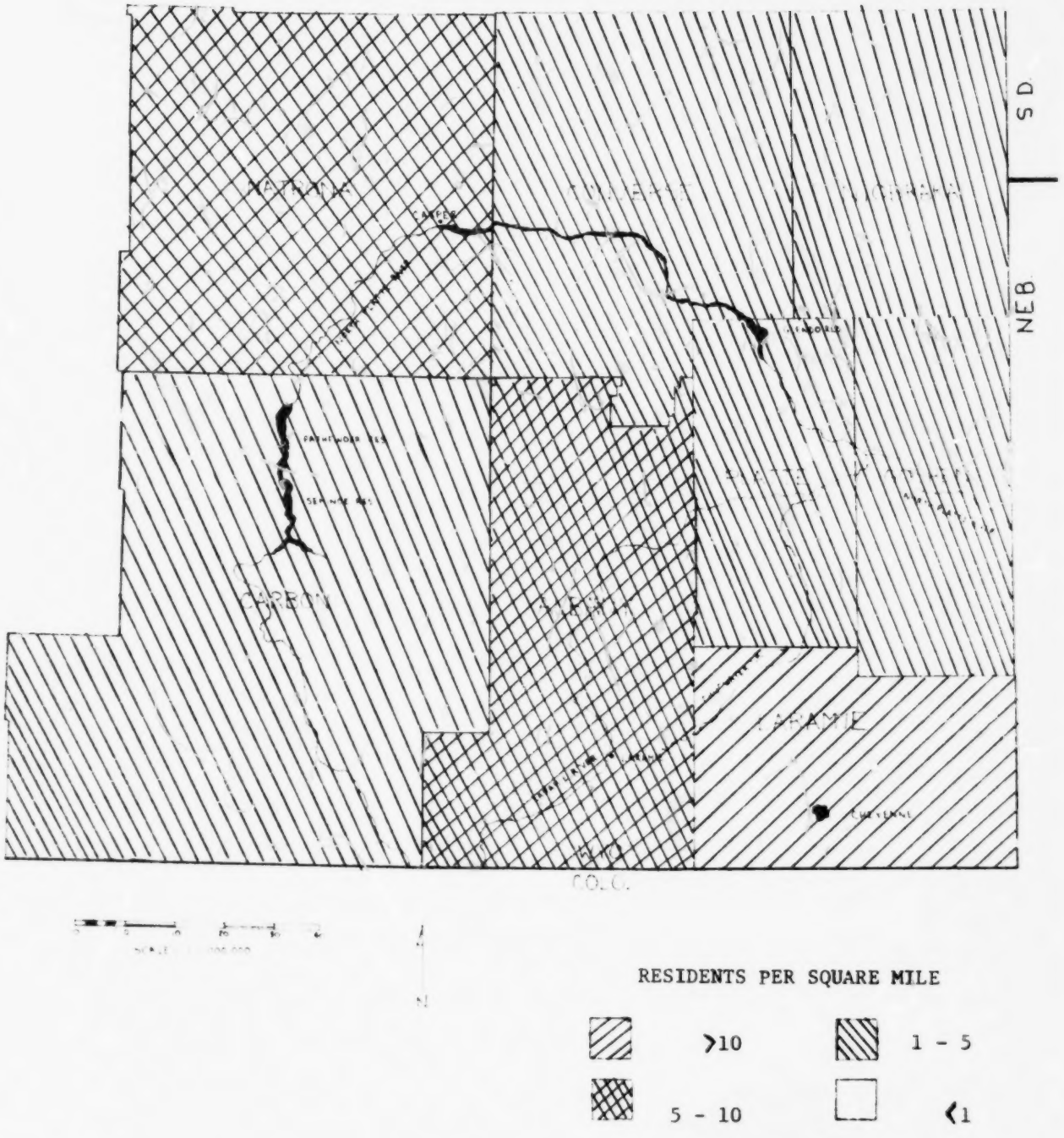


FIGURE 4. PRESENT POPULATION DENSITIES IN SOUTHEASTERN WYOMING

Reproduced from best available copy.

respectively, followed by Converse and Goshen. During the next ten years, the eight-county study area should increase a substantial 21.4%, from 166,500 to 202,050.

It should be noted that all of the predicted population declines will occur in essentially rural counties, while the more densely populated counties, Albany, Laramie, and Natrona, should add large numbers of people. This reflects the general trend of population migration from rural to urban areas in the State.

MANUFACTURING ACTIVITY

The location of manufacturing activity is helpful in determining the size of an air quality control region since industrial sources are often substantial contributors of air pollutant emissions. Manufacturing employment statistics and land use information have been used to provide an indication of the geographic location and extent of industrial activity in the southeastern Wyoming area.

Table II and Figure 5 provide information on the distribution of manufacturing employment in Southeastern Wyoming, based on 1968 data. These figures indicate that manufacturing employees are by far most numerous in Natrona and Laramie Counties, in that order. The bordering counties are primarily rural and contain very little industry, as evidenced by the low numbers of manufacturing employees within them.

As expected, most of the industry in Laramie and Natrona Counties is located in the cities of Cheyenne and Casper, respectively,

TABLE II

MANUFACTURING EMPLOYMENT BY JURISDICTION[6/]

County	Land Area (Sq. Miles)	1968 Mfg Employment	1968 Mfg. Empl. Density	1968 % of Work Force Engaged in Mfg.
Albany	4,248	500	0.1	13.2
Carbon	7,905	382	0.1	14.9
Converse	4,282	NA	NA *	NA
Goshen	2,228	110	0.1	8.5
Laramie	2,703	982	0.4	9.5
Natrona	5,342	1,236	0.2	9.9
Niobrara	2,614	NA	NA *	NA
Platte	2,086	75	0.1	7.1

* No figures were available for Converse and Niobrara Counties

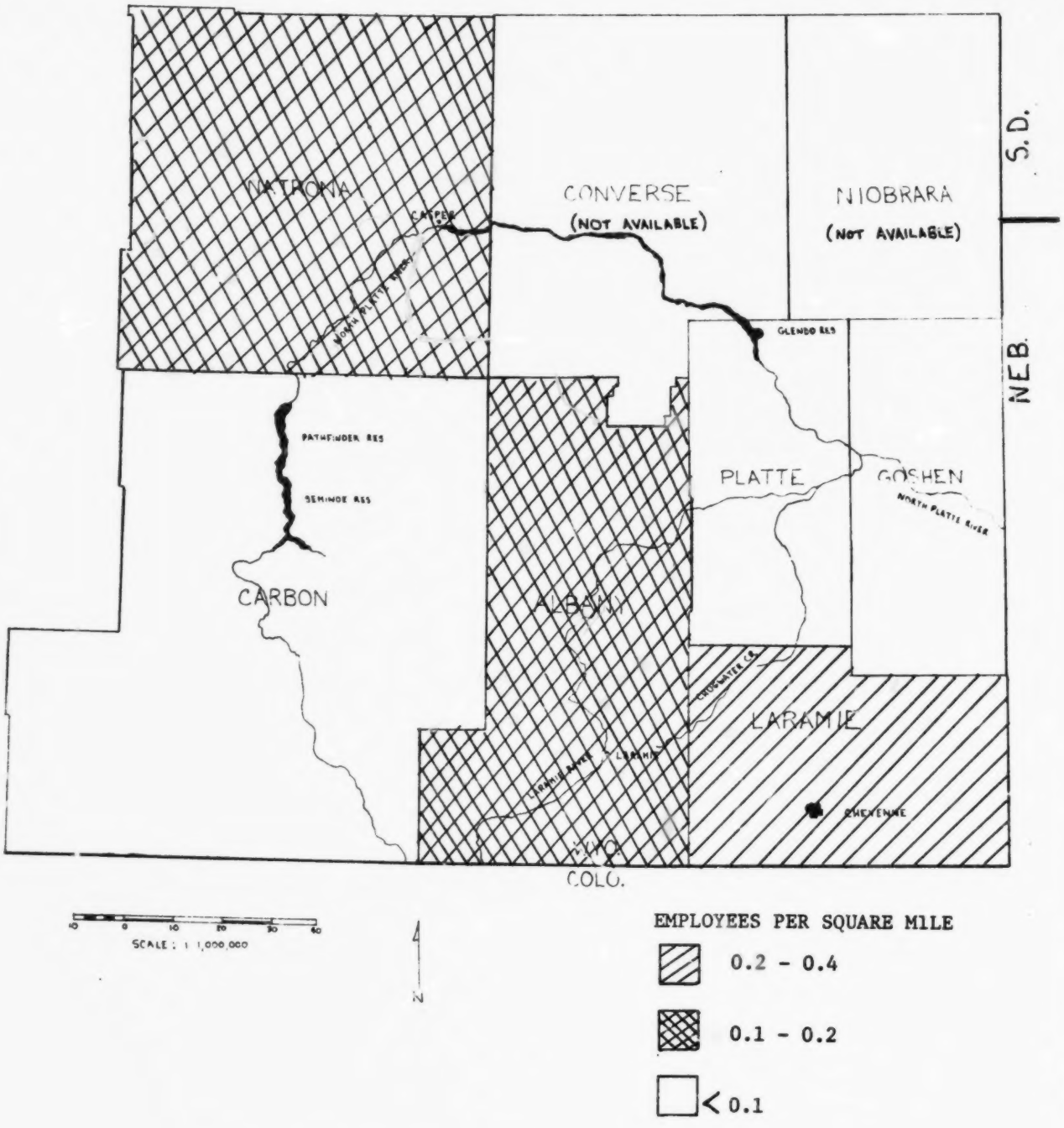


FIGURE 5 1968 MANUFACTURING EMPLOYMENT DENSITIES

where the bulk of the population resides. In Laramie County, the major manufacturing activities are quite diversified and include food and kindred products (161 employees) and the petroleum and coal products (727 workers) industries. Generally, tourism has been and will be the most important source of income in southeastern Wyoming, as evidenced by the large numbers of people employed in the retail trades and services occupations. However, manufacturing activities are expected to play a more important role in the future.

EXISTING REGIONAL ARRANGEMENTS

The geographic extent of regional planning commissions, councils of local governments, State-defined planning and economic development districts, and region-wide statistical data-gathering based is an important consideration affecting the selection of air quality control region boundaries. The designation of a region compatible with these existing regional arrangements is desirable since the implementation of a regional air pollution control effort is dependent upon cooperation at the various levels of government. Furthermore, region-wide planning programs may be capable of providing assistance in the development of air quality standards and a plan to implement those standards.

At the present time, only metropolitan or county-wide planning is conducted in the study area. In Laramie County, the county zoning and planning commission functions as such an agency. There

are at present, however, no regional or multi-county planning agencies operative in southeastern Wyoming. Although no formal joint planning is carried out among Albany, Goshen, Laramie, and Platte Counties, they nevertheless maintain close working relationships.

The Public Health Service provides grants to local governmental organizations for area-wide comprehensive health planning. The planning areas should have a population of sufficient size so that a full range of physical, mental and environmental health services, facilities and manpower is or can be available within the area. This means that in some cases rural territories may have to associate with urban areas in conducting a comprehensive health planning program. A State agency has been designated for Wyoming concurrent with the naming of a State comprehensive planning director. No area-wide agencies have been designated yet, but several are planned.

EXISTING AIR POLLUTION CONTROL PROGRAMS

The Wyoming Air Quality Act was passed by the Wyoming Legislature in 1967 to "...protect the purity of the air resources of the State of Wyoming and to prevent, control and abate air pollution therein..." In addition, the Act created the Wyoming Air Resources Council under the Public Health Department, defining its powers and duties. The council was charged with several duties relating to air resources, such as formulating pollution abatement and control plans, adopting regulations, standards, and procedural methods for reducing air pollution, and to hold hearings in connection with these. However,

the Act was explicit in pointing out that full enforcement and administration of any standards and regulations would be done under the Wyoming Department of Public Health.

In August 1969, the Air Resources Council adopted air quality standards were established for sulfur oxides, hydrogen sulfide, oxidant, nitrogen oxides, and gaseous fluorides, In addition, the council adopted restrictions on open burning, particulate emissions from industrial process and fuel burning for heating, odorous emissions, the construction and operation of wood waste burners, and motor vehicle pollution.

On the county and municipal levels, no air pollution programs in the proposed Region have yet been established, although a few local jurisdictions have begun preliminary studies.

EVALUATION OF ENGINEERING FACTORS

POLLUTANT EMISSIONS INVENTORY

The compilation of an air pollutant emissions inventory makes possible the correlation of pollutant emissions with specific geographic locations. This procedure generally results in the determination of the "core" of an air quality control region, that is, the area where the bulk of the pollutant emissions occur.

The emissions inventory for the Cheyenne, Wyoming study area was conducted by the National Air Pollution Control Administration. The survey area, shown in Figure 6, included Albany, Goshen, Larmaie, and Platte Counties. These four counties together account for the great majority of the population, urban development and industrial activity in southeastern Wyoming.

The Public Health Service rapid survey technique was used for the estimation of pollutant emissions. The emissions were calculated from data representative of the year 1969. Table III provides a county breakdown of sulfur oxide, total particulates, carbon monoxide, hydrocarbon, and nitrogen oxide emissions according to source type of four general categories: transportation, fuel combustion (stationary sources), refuse disposal, and industrial process. The information in Table III shows that 48% of the total sulfur oxides emitted in the proposed Region are due to industrial fuel combustion. Industrial processes account for 83% of the

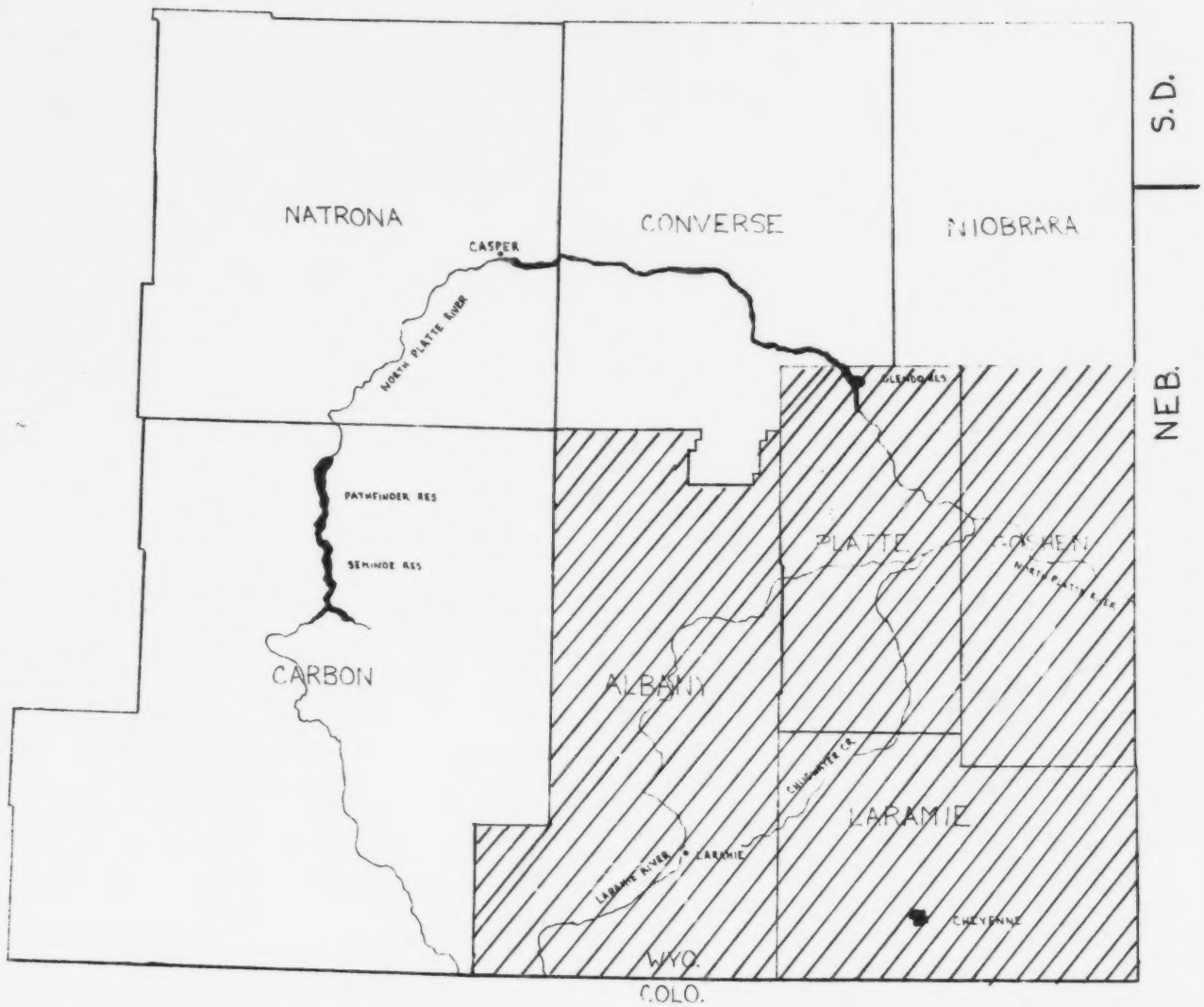

NATRONA
CONVERSE
NIOBRARA
S.D.
NEB.
CASPER
NORTH PLATTE RIVER
GLENDO RES
PATHFINDER RES
SEMINOE RES
CARBON
ALBANY
PLATTE
GOSHEN
NORTH PLATTE RIVER
CHUGWATER CR.
LARAMIE
LARAMIE RIVER
LARAMIE
CHEYENNE
WYO.
COLO.

TABLE 111

SUMMARY OF AIR POLLUTANT EMISSIONS IN THE CHEYENNE STUDY AREA, 1968 (Tons/Year) 1/

	County	Transportation: Motor Vehicles	Transportation: Other	Fuel Combustion in Stationary Sources: Industry	Fuel Combustion in Stationary Sources: Steam-Electric	Fuel Combustion in Stationary Sources: Residential	Fuel Combustion in Stationary Sources: Commercial & Institu.	Refuse Disposal: Incineration	Refuse Disposal: Open Burning	Industrial Processes	Evaporative Losses	County* Total
Sulfur Oxides	Albany	105	0	1,202	0	9	41	2	15	0	0	1,375
	Goshen	46	0	0	0	8	12	0	6	0	0	74
	Laramie	252	0	1	0	54	56	25	12	656	0	1,057
	Platte	38	0	0	0	6	5	0	3	0	0	54
	Total	441	0	1,203	0	77	114	27	36	656	0	2,560
Total Particulates	Albany	202	0	3,952	0	14	21	12	247	28,915	0	33,364
	Goshen	88	0	9	0	4	4	4	100	346	0	557
	Laramie	484	37	65	0	28	43	125	206	16	0	1,004
	Platte	72	0	3	0	2	5	2	60	1	0	146
	Total	846	37	4,029	0	48	73	143	613	29,278	0	35,071
Carbon Monoxide	Albany	12,890	0	105	0	0	1	52	1,313	1,583	0	15,947
	Goshen	4,766	0	0	0	0	0	20	535	0	0	5,323
	Laramie	30,974	7,444	1	0	2	2	552	1,094	20,001	0	60,071
	Platte	3,933	0	0	0	0	0	12	319	0	0	4,264
	Total	52,563	7,444	106	0	2	3	636	3,261	21,584	0	85,605
Hydro-carbons	Albany	1,174	0	35	0	0	1	0	463	135	1,105	2,916
	Goshen	459	0	0	0	0	0	0	189	0	480	1,128
	Laramie	2,822	1,393	0	0	2	2	10	386	2,226	1,546	14,389
	Platte	378	0	0	0	0	0	0	112	0	390	882
	Total	4,833	1,393	35	0	2	3	10	1,150	2,361	9,521	19,315
Nitrogen Oxides	Albany	1,127	0	928	0	79	115	3	170	7	0	2,413
	Goshen	491	0	118	0	19	25	1	69	0	0	724
	Laramie	2,697	356	773	0	137	243	37	141	1,463	0	5,848
	Platte	405	0	38	0	12	28	0	41	0	0	528
	Total	4,720	356	1,857	0	247	411	41	421	4,470	0	9,513

* Rounded Totals

total particulates and 25% of all carbon monoxide emissions. The largest portion of carbon monoxide (61.4%) and nitrogen oxides (50%) can be traced to motor vehicles. Finally, nearly 50% of all hydrocarbon emissions are due to evaporative losses.

In Table IV the percentage contributed by each county to the total of the five pollutants are listed. These numbers indicate that the majority of sulfur oxides (53.7%) and particulate emissions (95.1%) can be traced to Albany County. Laramie County is by far the major source of carbon monoxide, hydrocarbons, and nitrogen oxides, with respective values of 70.2%, 74.5% and 61.5%. Source locations within the survey area were defined by grid coordinates based on the Universal Transverse Mercator (UTM) system. Figure 7 shows the grid system superimposed over an outline of the four-county survey area. Grid squares three miles on a side were used in areas of greatest urban development, while grid zones of 6, 9, 12, and 25 miles on a side were used in less intensely developed areas. A summary of sulfur oxide, particulate, and carbon monoxide emissions for each grid zone is listed in Table V, and emission density maps for these pollutants are presented in Figures 8, 9, and 10, respectively.

Figure 11 shows the location of the major point sources in the study area. The sulfur oxide and total particulate emission density patterns reflect the location of major point sources in the area. The density maps show that the highest SO_x and particulate

TABLE IV

PERCENTAGE CONTRIBUTION OF EACH COUNTY
TO THE TOTAL AIR POLLUTANT EMISSION

COUNTY	SULFUR OXIDES	PARTICULATES	CARBON MONOXIDE	HYDRO-CARBONS	NITROGEN OXIDES
Albany	53.7	95.1	18.6	15.1	25.4
Goshen	2.9	1.6	6.2	5.8	7.6
Laramie	41.3	2.9	70.2	74.5	61.5
Platte	2.1	0.4	5.0	4.5	5.5

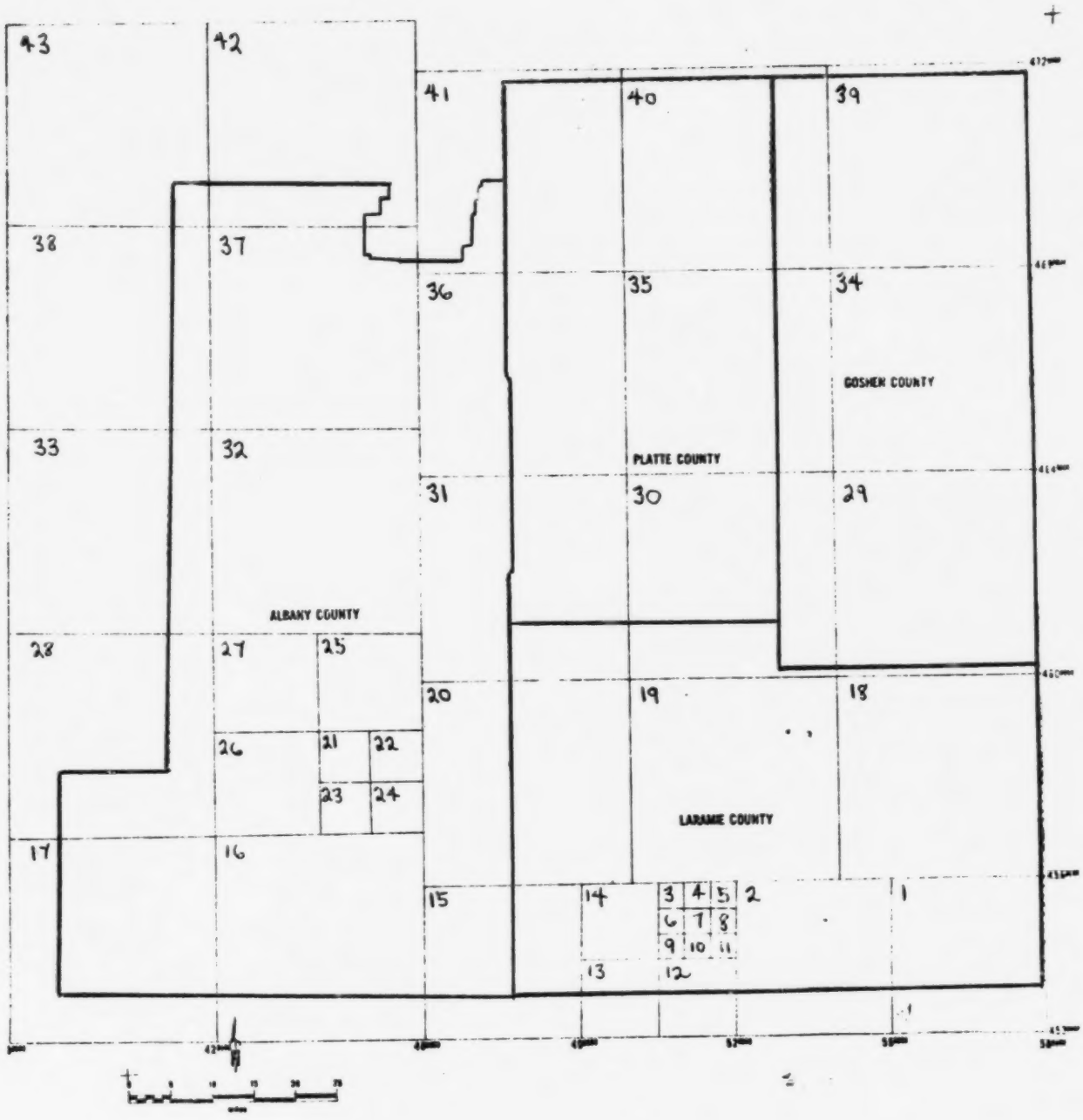


FIGURE 7. EMISSIONS INVENTORY GRID COORDINATE SYSTEM

TABLE V

SUMMARY OF AIR POLLUTANT EMISSIONS FOR GRID AREAS

Grid No.	Area (Sq Mi.)	Sulfur Oxides Total (Tons/yr)	Sulfur Oxides Density (Tons / Yr-Mi^2)	Particulates Total (Tons/yr)	Particulates Density (Tons)	Carbon Monoxide Total (Tons/yr)	Carbon Monoxide Density (Tons / Yr-Mi^2)
1	347.4	0.1	0.00	0.1	0.00	3.9	0.01
2	347.4	0.0	0.00	0.0	0.00	1.4	0.00
3	9.6	0.2	0.02	0.5	0.05	14.1	1.46
4	9.6	0.1	0.01	0.4	0.05	31.2	3.23
5	9.6	0.0	0.00	0.0	0.00	1.2	0.12
6	9.6	0.1	0.01	0.3	0.03	10.8	1.12
7	9.6	2.0	0.21	0.7	0.07	75.1	7.78
8	9.6	0.0	0.00	0.0	0.00	1.1	0.12
9	9.6	0.0	0.00	0.1	0.01	0.5	0.05
10	9.6	0.0	0.00	0.0	0.00	1.1	0.11
11	9.6	0.0	0.00	0.0	0.00	0.3	0.03
12	86.8	0.0	0.00	0.0	0.00	0.8	0.01
13	86.8	0.0	0.00	0.0	0.00	0.5	0.01
14	86.8	0.0	0.00	0.0	0.00	0.1	0.00
15	347.4	0.0	0.00	0.1	0.00	3.3	0.01
16	617.7	3.3	0.01	90.0	0.12	2.3	0.00
17	617.7	0.0	0.00	0.0	0.00	0.6	0.00
18	617.7	0.2	0.00	0.3	0.00	16.0	0.03
19	617.7	0.0	0.00	0.1	0.00	3.6	0.01
20	617.7	0.0	0.00	0.0	0.00	0.5	0.00
21	38.6	0.0	0.00	0.1	0.00	5.2	0.13
22	38.6	0.0	0.00	0.4	0.01	3.4	0.09
23	38.6	0.0	0.00	0.1	0.00	2.1	0.06
24	38.6	0.2	0.01	0.5	0.01	14.9	0.38
25	154.4	0.0	0.00	0.0	0.00	2.3	0.01
26	154.4	0.0	0.00	0.0	0.00	0.3	0.00
27	154.4	0.0	0.00	0.0	0.00	0.6	0.00
28	617.7	0.0	0.00	0.0	0.00	0.1	0.00'
29	617.7	0.0	0.00	0.0	0.00	1.4	0.00
30	617.7	0.0	0.00	0.1	0.00	3.8	0.01
31	617.7	0.0	0.00	0.0	0.00	0.9	0.00
32	617.7	0.0	0.00	0.0	0.00	0.3	0.00
33	617.7	0.0	0.00	0.1	0.00	5.1	0.01
34	617.7	0.1	0.00	1.4	0.00	10.4	0.02
35	617.7	0.1	0.00	0.2	0.00	6.2	0.01
36	617.7	0.0	0.00	0.0	0.00	1.5	0.00
37	617.7	0.0	0.00	0.0	0.00	0.2	0.00
38	617.7	0.0	0.00	0.0	0.00	0.7	0.00
39	617.7	0.0	0.00	0.0	0.00	0.7	0.00
40	617.7	0.0	0.00	0.1	0.00	2.4	0.00
41	617.7	0.0	0.00	0.1	0.00	3.1	0.01
42	617.7	0.0	0.00	0.0	0.00	0.3	0.00
43	617.7	0.0	0.00	0.0	0.00	0.5	0.00

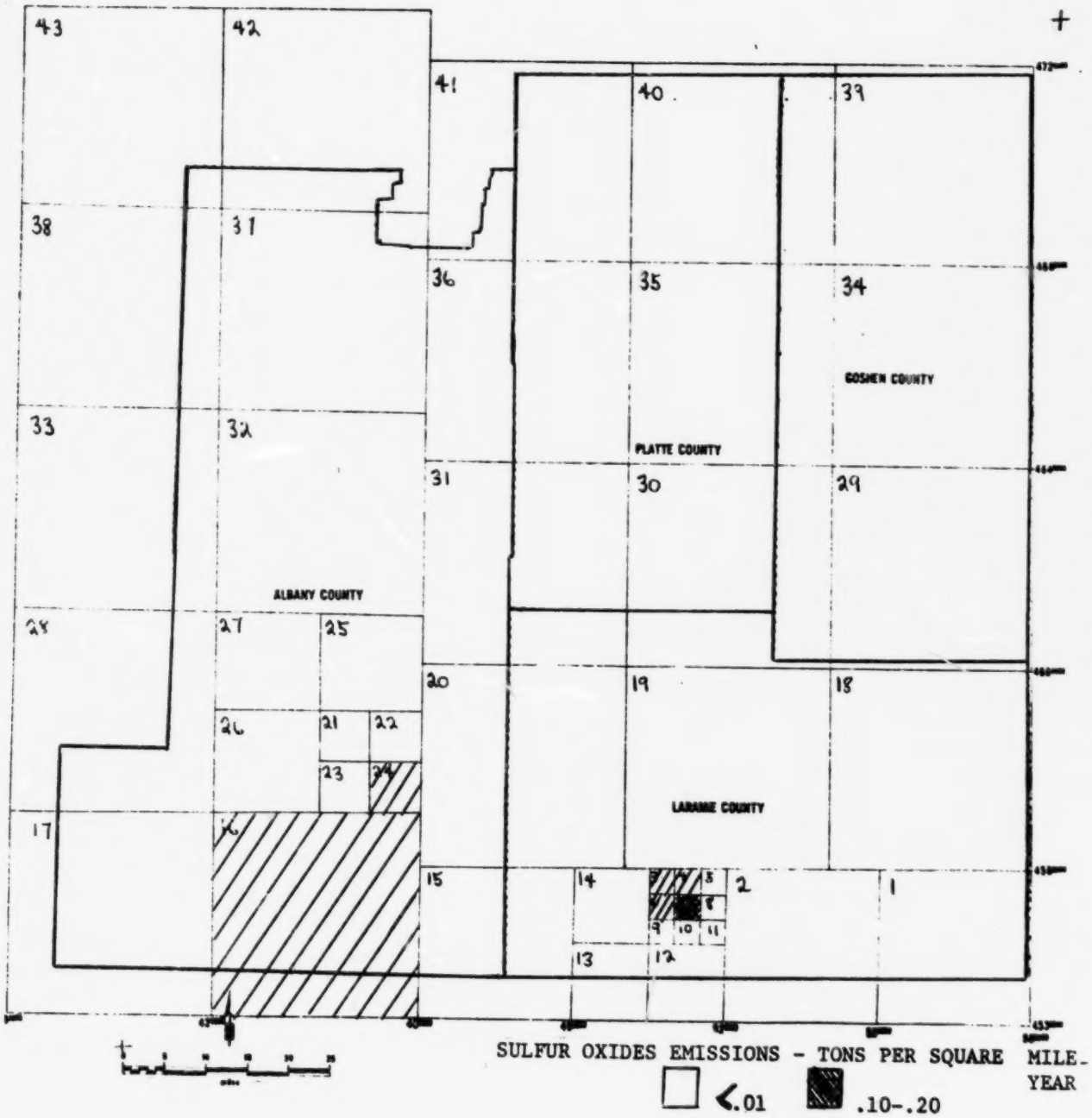


FIGURE 8. SULFUR OXIDES EMISSIONS DENSITIES

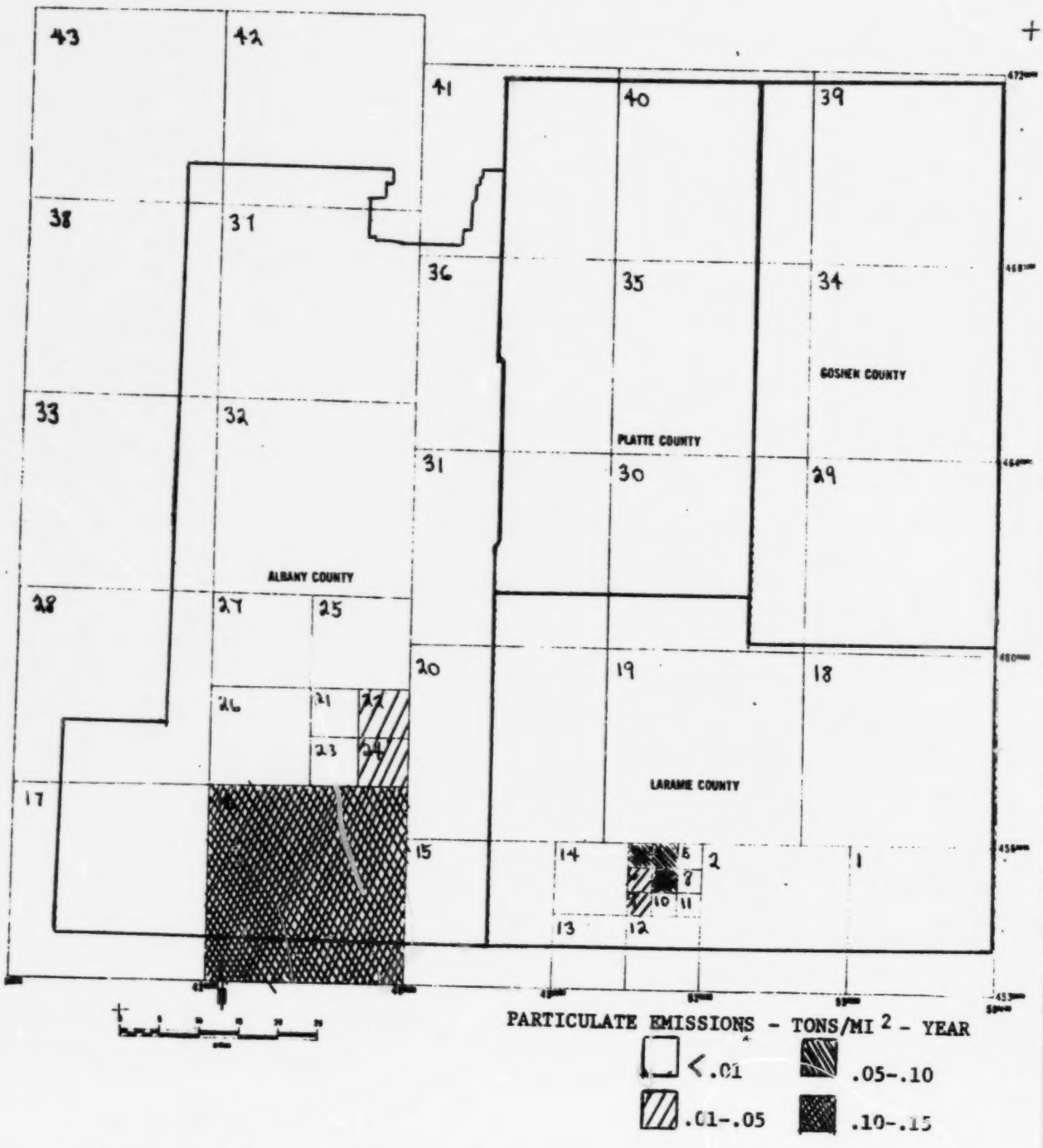


FIGURE 9. PARTICULATE EMISSION DENSITIES

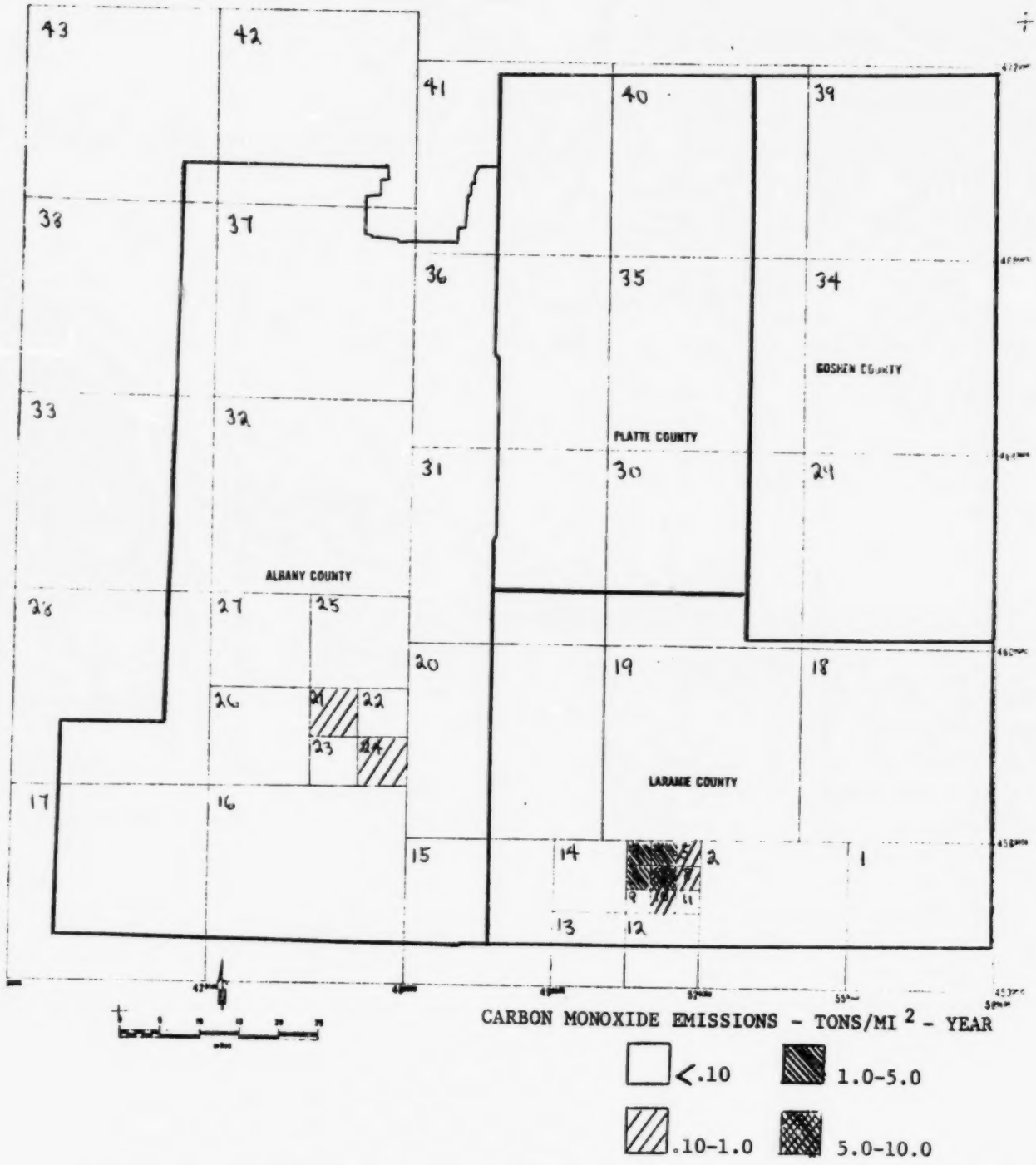


FIGURE 10. CARBON MONOXIDE EMISSION DENSITIES

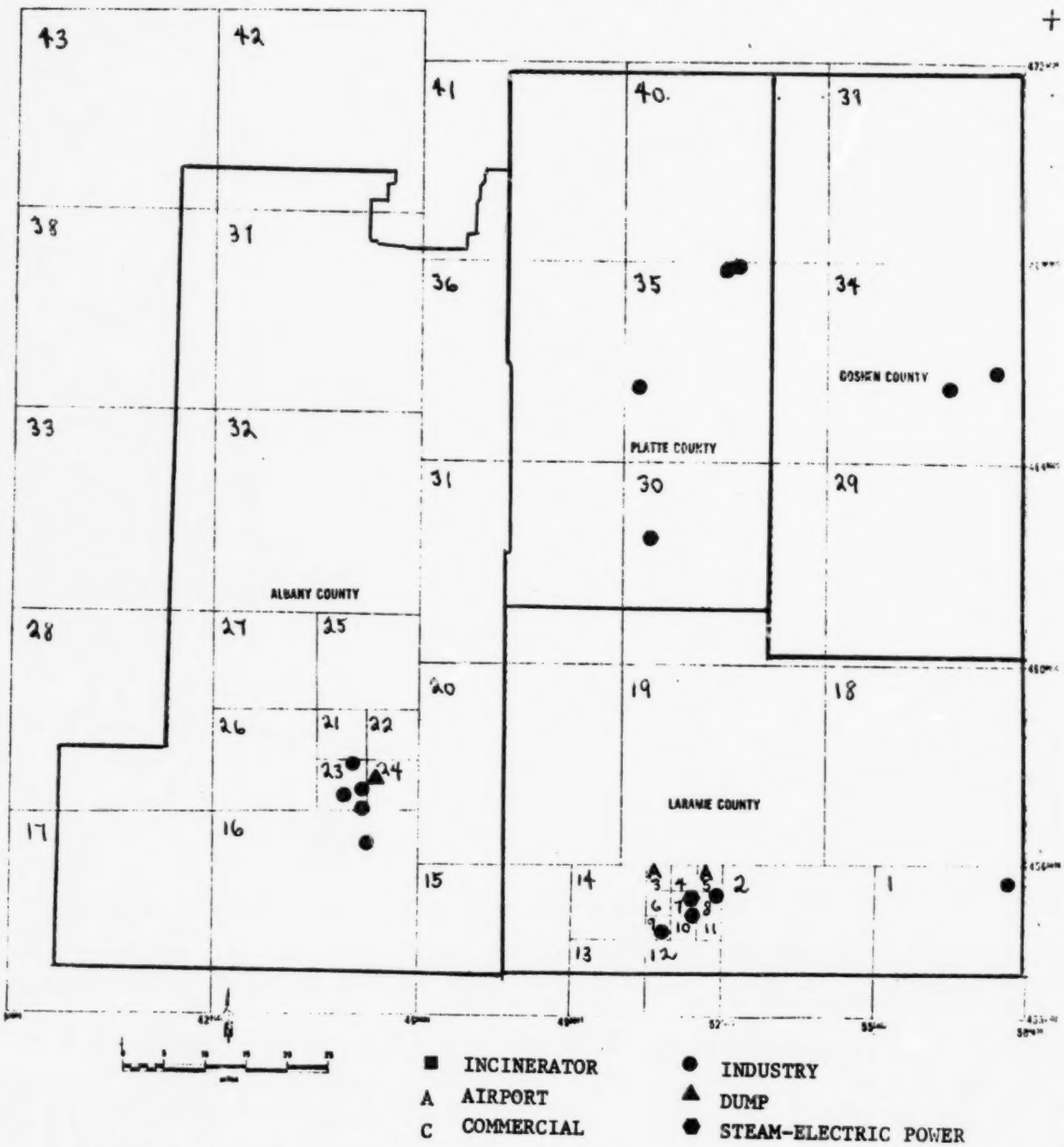


FIGURE 11. LOCATION OF MAJOR POINT SOURCES

emissions originate, as would be expected, in the Cheyenne and Laramie Urganized Areas. The point source map, Figure 11, corroborates this; it indicates that 10 of the 18 major sources are located in and around these two cities. Carbon monoxide emission patterns similarly reflect the urban development in Cheyenne and Laramie, where vehiclar traffic is heaviest (see Figure 10).

AIR QUALITY

Introduction

The regional approach to air resource management requires that those jurisdictions containing the majority of the sources of pollution in a metropolitan area be included within a single air quality control region. An air quality control region should also include jurisdictions containing the majority of the people and property adversely affected by air pollutant emissions from those same sources. The core area of a region can be roughly defined on the basis of pollutant point source locations and relative emission densities. However, information on present levels of pollution in the ambient air is helpful in order that peripheral pollutant receptor areas can be identified. The selection of an essentially self-contained region will result - a region which will include within its bounds virtually the entire source receptor system for a particular area. By using this approach, the possibility of pollutant cross-boundary transport problems will be minimized.

The following sections discuss briefly the factors likely to affect air pollution potential in southeastern Wyoming. These factors are topography and meteorology. In addition, a brief discussion of existing air quality is presented.

Topography

The southeastern corner of Wyoming is characterized by high

elevations ranging from 6,000 to 9,000 feet above sea level near Cheyenne. The countryside is mostly rolling prairie which is used primarily for grazing. As one travels west, the ground level rises rapidly to a ridge approximately 9,000 feet elevation about 30 miles west of Cheyenne. This ridge is known as the Laramie Mountains, one of the ranges of the Rockies, and extends in a north-south direction through Albany County. The terrain in the area is dotted with numerous lakes and reservoirs. The largest of these, Pathfinder Reservoir, in Natrona and Carbon Counties lies in the course of the North Platte River. This river, the largest water artery in Wyoming, is formed by the confluence of Cow and Encampment Creeks in southern Carbon County and then flows northward into the Seminole and Pathfinder Reservoirs. The river then meanders along a southeasterly course successively through Natrona, Converse, Platte, and Goshen Counties. The other major stream in the proposed Region, Crow Creek, is a tributary of the North Platte and flows south from Wendover through Platte and Laramie Counties to Cheyenne. Although the topography in southeastern Wyoming is quite rugged, it is quite consistent with the essential absence of confining features such as narrow river valleys, so that the dispersion of air pollutants is not appreciably restricted. As a result, topography is not a pertinent factor in determining Region boundaries in this case.

Meteorology

The meteorology is southeastern Wyoming is generally favorable to the diffusion of air pollutants. The largest contributing factors to this are the seasonal wind conditions. Wind data obtained at Cheyenne, Wyoming is presented in Figure 12. The wind roses are shown for the winter, summer and annual averaging times and depict the relative frequency of occurrence of wind blowing from the 16 compass directions. Generally, the wind prevails from the westerly quadrants at average velocity of 12 mph. During the months of June through July, the prevailing winds are from west to west-southwest, whereas the predominate direction during the winter months (December through February) is west to west-northwest at relatively high velocities (13 mph). These westerly winds flow downslope from the Laramie Mountains and have a marked chinook effect on the area which is especially noticeable in the winter months. Since Cheyenne is located on a broad ridge, winds from either the north or south, as well as any easterly direction are upslope. With the proper amount of moisture present upslope winds may cause fog or low stratus clouds to form which may, in turn, contribute to the intensity of an air pollution episode, if one were to occur.

An important indicator of atmospheric conditions are the average mixing depths which provide a measure of the volume within which pollutants may mix without restriction. Pollutant dilution is most restricted during the mornings and least constrained in the

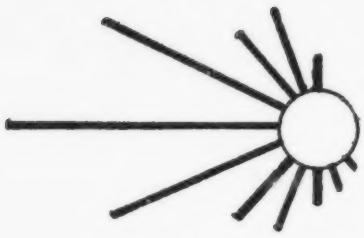
afternoons. Morning and afternoon average mixing depths for various averaging times are presented in Table VI. Inversions in southeastern Wyoming occur infrequently; long term inversion periods occur rarely, if at all. Because of these conditions, no forecast high air pollution potential days (air pollution episodes) occurred in the study area between August 1960 and August 1969.

TABLE VI: Averaging Mixing Depths by Season and Time of Day

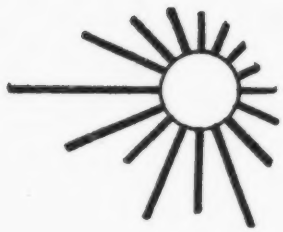
Season	Morning Average	Afternoon Average	Average Morning & Afternoon
Winter	170	1,150	660
Summer	250	3,000	1,625
Annual (4 seasons)	235	2,215	1,225

Air Quality

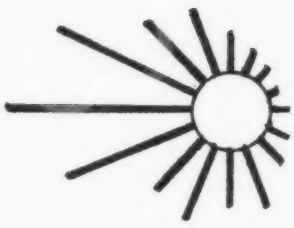
The National Air Surveillance Network of the National Air Pollution Control Administration measured the suspended particulates, dustfall, and sulfation rates for the city of Cheyenne. Appearing in Table VII are suspended particulte readings for the years 1957 to 1968. During this period, the particulate concentrations decreased from 51 micrograms per cubic meter in 1957 to 29 micrograms per cubic meter in 1968.



WINTER



SUMMER



ANNUAL

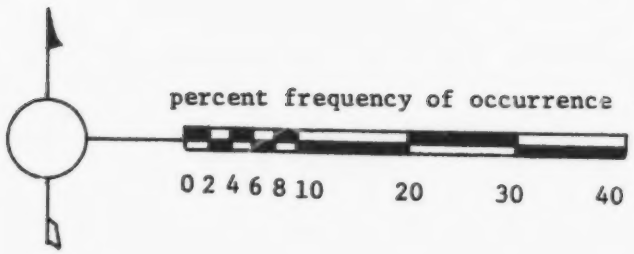


FIGURE 12 WIND DIRECTION PERCENT FREQUENCY OF OCCURRENCE FOR VARIOUS AVERAGING TIMES

TABLE VII

SUSPENDED PARTICULATES ($\mu g/m.^3$) 12/

Year	No of Samples	Min.	Max.	Geo. Mean
1957	26	22	130	51
1958	24	16	100	50
1959	26	13	94	41
1960	22	13	82	34
1961	25	10	68	29
1962	26	7	83	33
1963	24	13	73	41
1964	25	16	103	40
1965	25	6	97	31
1966	26	14	90	32
1967	24	18	93	31
1968	26	12	99	29
1957-68	299	6	130	36

However, dustfall (nonsuspended partciulates) readings taken in Cheyenne show neither an increasing nor a decreasing trend from 1968 to 1969. When compared to the national cumulative frequency distribution for dustfall, these readings are less than the 50th percentile for nearly all months of the year. Both the dustfall values and the frequency distribution appear in Table VIII.

Values for sulfation rate, using lead peroxide candles (an indication of sulfur oxide levels in the atmosphere) can also be compared to readings taken elsewhere in the country. As indicated in Table IX, all readings for Cheyenne fall beneath the 50th percentile.

TABLE VIII

DUSTFALL MEASUREMENTS FOR CHEYENNE WYOMING[9/, 10/]

A. READINGS

Year	Month	Dustfall (g/m^2)
1968	July	30.0
1968	Aug	2.0
1968	Sept	3.0
1968	Oct	1.9
1968	Nov	1.3
1968	Dec	0.5
1969	Jan	1.1
1969	Feb	2.6
1969	March	5.4
1969	April	2.2
1969	May	2.7
1969	June	5.0

TABLE VIII
(Cont.)

B. NATIONAL CUMULATIVE FREQUENCY DISTRIBUTIONS BY MEASUREMENT

Year	Month	Percent of Values Less than Stated Values							
		Min.	10%	25%	50%	75%	90%	Max.	No. Samples
1968	Jan	0.3	1.2	2.2	4.0	6.5	10.0	26.4	210
1968	Feb	0.3	1.3	2.1	3.5	6.0	9.6	29.3	217
1968	March	0.6	2.2	3.5	5.7	8.1	13.3	102.2	225
1968	April	0.4	2.1	3.2	5.5	9.0	13.2	161.2	231
1968	May	0.2	1.6	2.7	4.9	7.3	11.7	34.0	225
1968	June	0.1	2.0	3.2	4.8	7.5	11.4	38.7	235
1968	July	0.3	1.7	2.8	4.5	7.1	10.7	44.3	244
1968	Aug	0.3	1.8	2.6	4.2	6.4	9.9	37.3	247
1968	Sept	0.5	1.5	2.4	4.0	6.3	9.3	30.0	250
1968	Oct	0.2	1.5	2.5	4.1	6.2	9.2	36.4	252
1968	Nov	0.1	1.3	2.6	4.2	6.6	11.1	26.9	242
1968	Dec	0.2	1.3	2.2	3.8	6.2	9.8	39.8	229
Jan-Dec., 1968:		0.1	1.5	2.6	4.4	6.9	10.8	161.2	2,807

TABLE IX

SULFATION (LEAD PEROXIDE CANDLES) FOR CHEYENNE WYOMING 9/

A. READINGS

Year	Month	Sulfation Rate ($mgSO_3/100cm^2/day$)
1968	July	0.0
1968	Aug	0.0
1968	Sept	0.0
1968	Oct	0.1
1968	Nov	0.1
1968	Dec	0.0

B. NATIONAL CUMULATIVE FREQUENCY DISTRIBUTION BY MEASUREMENT

		Percent of Values Less Than Stated Values							
Year	Month	Min.	10%	25%	50%	75%	90%	Max.	No. Samples
1968	July	0	0	0	0.2	0.7	1.3	4.6	242
1968	Aug	0	0	0	0.1	0.6	1.2	4.3	246
1968	Sept	0	0	0	0.2	0.6	1.2	4.7	253
1968	Oct	0	0	0	0.3	0.9	1.5	5.1	253
1968	Nov	0	0	0.1	0.3	1.2	1.7	4.0	245
1968	Dec	0	0	0	0.5	1.2	1.8	5.7	219

THE PROPOSED REGION

Subject to the scheduled Consultation, the Secretary, Department of Health, Education, and Welfare, proposes to designate air air quality control region for the Cheyenne, Wyoming intrastate area. The proposed Region consists of the following jurisdictions in the State of Wyoming:

Albany County
Goshen County
Laramie County
Platte County

As so proposed, the Metropolitan Cheyenne Intrastate Air Quality Control Region would consist of the territorial area encompassed by the outermost boundaries of the above jurisdictions and the territorial area of all municipalities located therein and as defined in Section 302(f) of the Clean Air Act, as amended, (42 U.S.C. 1857h(f)). The boundaries of the proposed Region are shown in Figure 13.

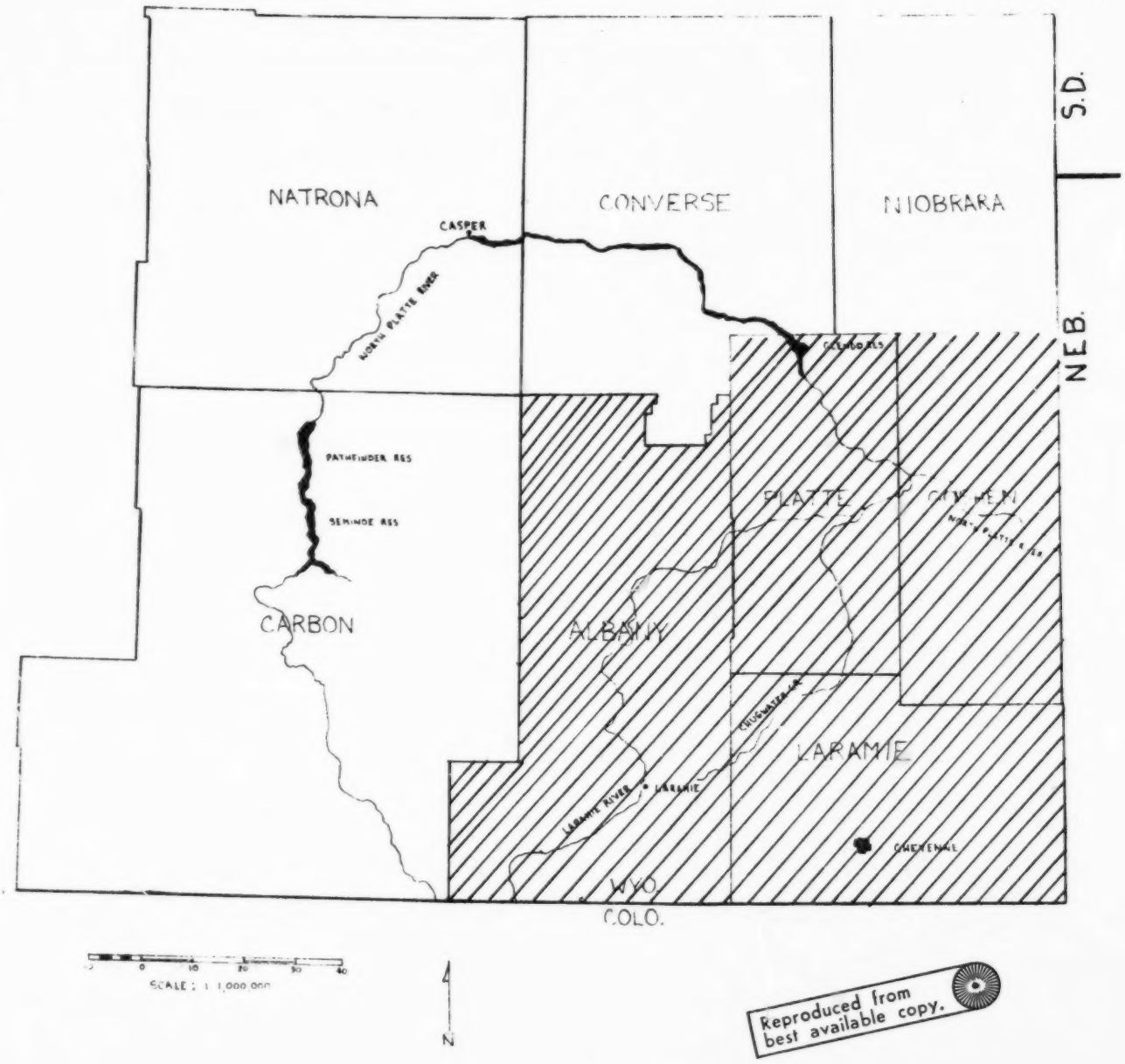


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FIGURE 13. PROPOSED METROPOLITAN CHEYENNE INTRASTATE AIR QUALITY CONTROL REGION

DISCUSSION OF PROPOSAL

To implement a successful air resource management program, an air quality control region should be large enough to encompass most air pollution sources as well as most people and property affected by those sources. The boundaries should also include those locations where present development creates, or where projected urbanization and industrialization will create, significant air pollution problems. Finally, the region should be compatible with or hopefully even foster unified and cooperative governmental administration of the air resource. The proposed Metropolitan Cheyenne Intrastate Air Quality Control Region was designed to satisfy, in the best way, these requirements.

Preliminary investigations indicated that the emissions inventory, if restricted to Albany, Goshen, Laramie, and Platte Counties, would encompass virtually all of the major air pollutant sources and source areas in southeastern Wyoming. Albany, Goshen, Laramie, and Platte Counties - particularly the cities of Cheyenne and Laramie - possess by far, the bulk of the population and manufacturing activity in the southeastern Wyoming. Because of the concentration of population in these two cities a relatively high percentage of the population of the Region can be classified as urban. In contrast to the intense development in Cheyenne and Laramie, the rest of the area does not lend itself to such development. Thus, buffer zones are formed by the surrounding counties between the cities and the rest of the State.

Future population and manufacturing trends would heighten the existing disparity in intensity of development of Albany and Laramie Counties and the rural Goshen and Platte Counties. The bulk of the added manufacturing growth is expected to occur in the greater Cheyenne and Laramie areas. It seems that the rugged topography and the problems of inaccessibility associated with it will prohibit extensive development in the outlying areas.

At the present time, no regional multi-county planning agencies are operative in southeastern Wyoming. However, a planning and zoning commission has been established for Laramie County. In addition, the State Comprehensive Health Planning Agency established by the Public Health Service will eventually be supplemented with area-wide comprehensive health planning agencies to function on the county and municipality levels. The proposed Region would serve to foster and even encourage cooperation between these agencies, since air pollution, either actual or potential is, in fact, a health hazard.

The urban factors evaluation indicates that the Region should include a minimum of Albany and Laramie Counties. The technical factors also indicate inclusion of Goshen and Platte Counties, especially the pollutant dilution considerations. It was not felt tht sufficient evidence exists to warrant the inclusion of additional counties to the four-county proposal at the present time. The other major population center in the study area, Casper in Natrona County, would appear to contribute the nucleus for a

separate intrastate region in the center of Wyoming and is thus excluded from the Cheyenne Region. Therefore, the designation of this four-county region should serve to encourage the most effective use of State and local resources toward the solution of the problem of air pollution.

Because of the several distinct regions located in various portions of the State of Wyoming, and the fact noted earlier, that Statewide ambient air quality standards for certain pollutants have been adopted, it is recommended that the State of Wyoming give serious consideration to dividing the entire State into several air quality control regions. Such an approach can serve to place the entire State on a uniform and coordinated timetable to attack the problems of air pollution using the regional approach to air resource management.

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